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XI. *An Account of the Gymnotus Electricus, or Electrical Eel. In a Letter from Alexander Garden, M. D. F. R. S. to John Ellis, Esq. F. R. S.*

SIR,

Charles-Town, South Carolina,
Aug. 14, 1774.

Redde, Feb. 23,
1775.

A FEW days since, I went to see some very curious fish, which were brought here about nine or ten weeks ago from Surinam; and I was both surprized and delighted to observe their strange shape, and experience their wonderful properties. I had before received some vague account of such a fish; but I always thought, that much of what I heard was fabulous. There are five of these fishes now here, of different sizes, from two feet in length to three feet eight inches. The following description was made out from the longest and largest. It might have been much more accurate, if there had been a possibility of handling the fish, and examining it leisurely; or if I could have had a dead specimen, as many things relating to the internal and external structure could in that case have been more exactly ascertained. But this fish hath the amazing power of giving so sudden and so violent a shock to any person that touches it, that there is, I think, an absolute impossibility of ever examining accurately a living specimen,

specimen; and the person who owns them rates them at too high a price (not less than fifty guineas for the smallest) for me to get a dead specimen, unless one should die by accident; if that should happen, you may depend on having a more exact and accurate account for the Society.

GEORGE BAKER, mariner, who brought them here, intends to carry them to England; but as it is very uncertain whether they will arrive in health and all alive, I have recommended to him to get a small cask of rum, with a large bung, into which he may put any of them that may die, and so preserve them for the inspection and examination of the curious when he arrives.

The largest of these fish was three feet eight inches in length, when extending itself most, and might have been from ten to fourteen inches in circumference about the thickest part of his body. The head is large, broad, flat, smooth, and impressed here and there with holes, as if perforated with a blunt needle, especially towards the sides, where they are more regularly ranged in a line on each side. The *rostrum* is obtuse and rounded. The upper and lower jaws are of an equal length, and the gape is large. The nostrils are two on each side; the first large, tubular, and elevated above the surface; and the others small, and level with the skin, placed immediately behind the verge of the *rostrum*, at the distance of an inch asunder. The eyes are small, flattish, and of a blueish colour, placed about three quarters of an inch behind the nostrils, and more towards the sides of the head. The whole head seems to be well supported;
but

but whether with bones or cartilages, I could not learn. The body is large, thick, and roundish, for a considerable distance from the head, and then gradually grows smaller, but at the same time deeper, or becomes of an *acinaciform* shape, to the point of the tail, which is rather blunt. There are many light-coloured spots on the back and sides of the body, placed at considerable distances in irregular lines, but more numerous and distinct towards the tail. When the fish was swimming, it measured six inches in depth near the middle, from the upper part of the back to the lower edge of the fin, and it could not be more than two inches broad on the back at that place. The whole body, from about four inches below the head, seems to be clearly distinguished into four different longitudinal parts or divisions. The upper part or back is roundish, of a dark colour, and separated from the other parts on each side by the *lateral lines*; which, taking their rise at the base of the head, just above the pectoral fins, run down the sides, gradually converging, as the fish grows smaller, to the tail, and make so visible a depression or furrow in their course, as to distinguish this from the second part or division, which may be properly called the body, or at least, appears to be the strong muscular part of the fish. This second division is of a lighter and more clear blueish colour than the upper or back part, and seems to swell out somewhat on each side, from the depression of the lateral lines; but, towards the lower or under part, is again contracted, or sharpened into the third part, or *carina*. This *carina*, or heel, is very distinguishable

tinguishable from the other two divisions, by its thinness, its apparent laxness, and by the reticulated skin of a more grey and light colour, with which it is covered. When the animal swims gently in pretty deep water, the rhomboidal reticulations of the skin of this *carina* are very discernible; but when the water is shallow, or the depth of the *carina* is contracted, these reticulations appear like many irregular longitudinal *plicæ*. The *carina* begins about six or seven inches below the base of the head, and gradually widening or deepening as it goes along, reaches down to the tail, where it is thinnest. It seems to be of a strong muscular nature. Where it first takes its rise from the body of the fish, it seems to be about one inch or one inch and an half thick, and is gradually sharpened to a thin edge, where the fourth and last part is situated; *videlicet*, a long, deep, soft, wavy fin, which takes its rise about three or four inches at most below the head, and runs down along the sharp edge of the *carina* to the extremity of the tail. Where it first rises it is not deep, but gradually deepens or widens as it approaches to the tail. It is of a very pliable soft consistence, and seems rather longer than the body. The situation of the *anus* in this fish is very singular, being placed underneath, and being about an inch more forward than the pectoral fins, and consequently considerably nearer the *rostrum*. It is a pretty long *rima* in appearance; but the aperture must be very small, as the formed excrements are only about the size of a quill of a common dunghill fowl. There are two pectoral (if I

may call them so) fins, placed one on each side, just behind the head, over the *foramina spiratoria*, which are small, and generally covered with a lax skin, situated in the *axille* of these fins. These fins are small for the size of the fish, being scarcely an inch in length, of a very thin, delicate consistence, and orbicular shape. They seem to be chiefly useful in supporting and raising the head of the fish when he wants to breathe, which he does every four or five minutes, by raising his mouth out of the water. This shews that he has lungs and is amphibious, and the *foramina spiratoria* seem to indicate his having *branchiæ* likewise; but this I only offer as a conjecture, not being certain of the fact. I must now mention the appearances of a number of small cross bands, annular divisions, or rather *rugæ* of the skin of the body. They reach across the body down to the base of the *carina* on each side; but those that cross the back seem to terminate at the lateral lines, where new rings take their rise, not exactly in the same line, and run down to the *carina*. This gives the fish somewhat of a worm-like appearance; and indeed it seems to have some of the properties of this tribe, for it has a power of lengthening or shortening its body to a certain degree, for its own conveniency, or agreeable to its own inclination. I have seen this specimen, which I have measured three feet eight inches, shorten himself to three feet two inches; but besides this power of lengthening or shortening his body, he can swim forwards or backwards with apparently equal ease to himself, which is another property

perty of the vermicular tribe. When he swims forward, the undulation or wavy motion of the fin and *carina* begin from the upper part, and move downwards; but when he swims backwards, and the tail goes foremost, the undulations of the fin begin at the extremity of the tail or fin, and proceed in succession from that backwards to the upper part of the body; in either case he swims equally swift. Every now and then the fish lays himself on one side, as it were, to rest himself, and then the four several divisions of his body abovementioned are very distinctly seen; *videlicet*, the vermiform appearance of the two upper divisions; the retiform appearance of the *carina*; and the last, or dark-coloured fin, whose rays seem to be exceedingly soft and flexible, and entirely at the command of the strong muscular *carina*. When he is taken out of the water, and laid on his belly, the *carina* and fin lie to one side, in the same manner as the ventral fin of the *Tetraodon* does, when he creeps on the ground. I have been the longer and more particular in the description of the external structure of this animal's body, because I think, as it is of a most singular nature, and endowed with some amazing properties, even the most minute circumstance I was able to observe relating to it should be mentioned.

The person to whom these animals belong, calls them *Electrical Fish*; and indeed the power they have of giving an electrical shock to any person, or to any number of persons who join hands together, the extreme person on each side touching the fish, is their most singular and

astonishing property. All the five we have here are possessed of this power in a very great degree, and communicate the shock to one person, or to any number of persons, either by the immediate touch of the fish with the hand, or by the mediation of any metalline rod. The keeper says, that when they were first caught, they could give a much stronger shock by a metalline conductor than they can do at present. The person who is to receive the shock must take the fish with both hands, at some considerable distance asunder, so as to form the communication, otherwise he will not receive it; at least I never saw any one shocked from taking hold of it with one hand only: though some have assured me, that they were shocked by laying one hand on him. I myself have taken hold of the largest with one hand often, without ever receiving a shock; but I never touched it with both hands, at a little distance asunder, without feeling a smart shock. I have often remarked, that when it is taken hold of with one hand, and the other hand is put into the water over its body, without touching it, the person received a smart shock; and I have observed the same effect follow, when a number joined hands, and the person at one extremity of the circle took hold of, or touched the fish, and the person at the other extremity put his hand into the water, over the body of the fish. The shock was communicated through the whole circle, as smartly as if both the extreme persons had touched the fish. In this it seems to differ widely from the *torpedo*, or else we are much misinformed of the manner
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in which the benumbing effect of that fish is communicated. The shock which our Surinam fish gives, seems to be wholly electrical; and all the phenomena or properties of it exactly resemble those of the electric *aura* of our atmosphere when collected, as far as they are discoverable from the several trials made on this fish. This stroke is communicated by the same conductors, and intercepted by the interposition of the same original electrics, or electrics *per se* as they used to be called. The keeper of this fish informs me, that he caught them in Surinam river, a great way up, beyond where the salt water reaches; and that they are a fresh water fish only. He says, that they are eaten, and by some people esteemed a great delicacy. They live on fish, worms, or any animal food, if it is cut small, so that they can swallow it. When small live fishes are thrown into the water, they first give them a shock, which kills or so stupifies them, that they can swallow them easily, and without any trouble. If one of these small fishes, after it is shocked, and to all appearance dead, be taken out of the vessel where the electrical fish is, and put into fresh water, it will soon revive again. If a larger fish than they can swallow be thrown into the water, at a time that they are hungry, they give him some smart shocks, till he is apparently dead, and then they try to swallow or suck him in; but, after several attempts, finding he is too large, they quit him. Upon the most careful inspection of such fish, I could never see any mark of teeth, or the least wound or scratch on them. When the electrical fish

are hungry, they are pretty keen after their food; but they are soon satisfied, not being able to contain much at one time. An electrical fish of three feet and upwards in length cannot swallow a small fish above three or at most three inches and a half long. Since I wrote the above description and remarks, I have had Mr. BANCROFT's Essay on the Natural History of Guiana put into my hands, in which I find an account of this animal; but, as I think that he has not been very particular in the description of it, I resolved still to send you the above account, that you might judge for yourself. I observe, that his account or description and mine differ in several things; and amongst others, where he says, that those fish were usually about three feet in length; but the one, of which I have sent a slight description, was three feet eight inches. This small variation might indeed have happened without any error; but I am told, that some of them have been seen in Surinam river upwards of twenty feet long, whose stroke or shock proved instant death to any person that unluckily received it.

I shall be on the watch to procure a more accurate knowledge of, and acquaintance with, this animal; and if I can learn any thing farther about it, you may depend on my communicating it.